H.H. Jeffcott developed the modern rotor dynamic equations

Henry Homan Jeffcott, born in Londonderry, Ireland in 1877, completed the job started by De Laval in 1883 to set the view of rotor dynamics on the right course. He created the idealized, Jeffcott model used in U.S. literature to analyze lateral shaft vibrations, and the first of the rotor dynamic equations as we use them today.

Jeffcott studied at Trinity College (Dublin University) where he received his B.A., B.A.I., and later his Sc.D. He began his career as an assistant engineer with Siemens Brothers and Company, Ltd. and W.G. Armstrong, Whitworth & Co., Ltd. in England. In 1905, he became the head of the Metrology Department, National Physical Laboratory, London where he conducted research in experimental mechanics. Five years later, he returned to Dublin, where he was appointed Professor of Engineering at the Royal College of Science for Ireland. He remained there until 1922, becoming Dean of Faculty in 1914. It was here that he published [1] his landmark paper, "The Lateral Vibration of Loaded Shafts in the Neighborhood of a Whirling Speed. - The Effect of Want of Balance," that introduced the Jeffcott model.

The model, consisting of a uniform and symmetric shaft supported by rigid bearings at each end, enabled him to discuss the motion of the rotating shaft. He concentrated the mass of the shaft at the midspan. The rest of the shaft, now massless, acted as the supporting springs. Jeffcott also introduced a damping force proportional to the velocity of the lateral motion. This made Jeffcott's model more representative of real rotor dynamic behavior.

Jeffcott used the model to explain the effect of unbalance when the rotative speed is near the natural frequency of the rotor. Vibration amplitude increases rapidly in this region. It was thought that the rotor speed could not exceed this "critical speed" (a concept introduced by Rankine some 50 years earlier), which is known today as the first balance resonance. The model includes both vertical and horizontal motion of the rotor, which defines orbital motion.

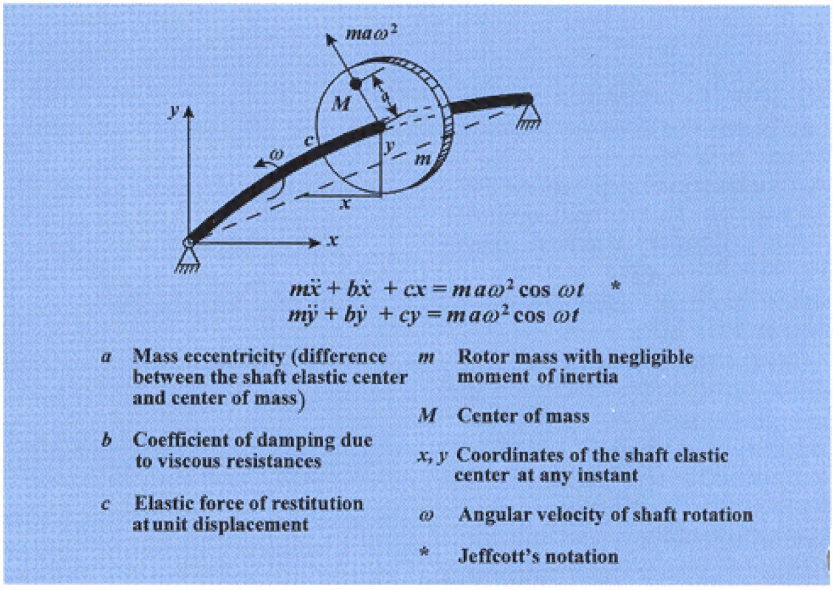
During the First World War, Jeffcott held the post of Secretary, Water Power Resources of Ireland Subcommittee, and was involved in manufacturing munitions in the college workshops, for the war effort, that is.

He was deeply involved in civil and mechanical engineering pursuits as a member of the board of studies and examiner in mechanical engineering at several universities. Jeffcott was a member of the Institution of Civil Engineers, Institution of Mechanical Engineers, and Royal Irish Academy. His published papers covered whirling shafts, electric transmission lines, surge chambers, hydroelectric investigations, hydraulic pipelines, heat engines cycles, and surveying instruments. He held several patents, including a direct reading tachometer.

Henry Homan Jeffcott, a pioneer in modern rotor dynamics, died June 29, 1937 in Walton-on-Thames, Surrey, England. ■

References

1. Philosophical Magazine, Series 6, Volume 37, 1919, pp 304-314.
2. World Who's Who in Science: a Biographical Dictionary of Notable Scientists from Antiquity to the Present, Chicago, Marquis-Who's Who, Inc., 1968.
3. Bently Nevada Corporation, "In honor of Henry Homan Jeffcott," Orbit, April 1985, pp 3-4.



$$m\ddot{x} + b\dot{x} + cx = ma\omega^2 \cos \omega t \quad *$$
$$m\ddot{y} + b\dot{y} + cy = ma\omega^2 \cos \omega t$$

a	Mass eccentricity (difference between the shaft elastic center and center of mass)	m	Rotor mass with negligible moment of inertia
		M	Center of mass
b	Coefficient of damping due to viscous resistances	x, y	Coordinates of the shaft elastic center at any instant
c	Elastic force of restitution at unit displacement	ω	Angular velocity of shaft rotation
		*	Jeffcott's notation

Figure 1
Jeffcott's model of a rotor.